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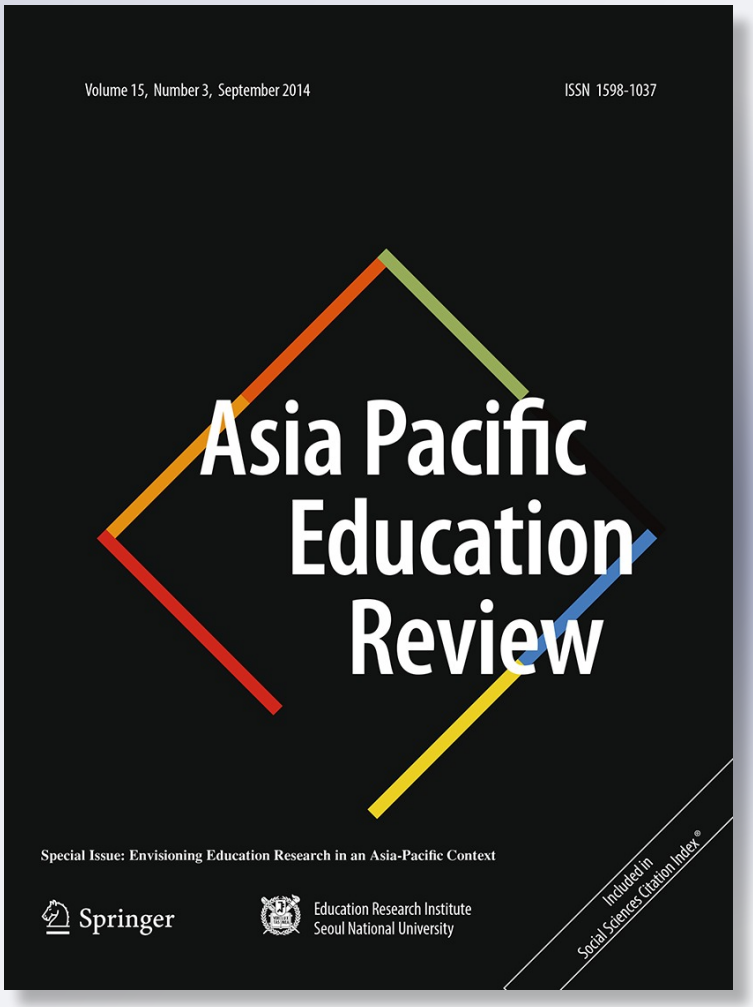

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An analysis of Asia–Pacific educational technology research published internationally in 2000–2013

Insung Jung · Mina Yoo

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Abstract The past fourteen years have seen a significant rise in the percentage of Asia–Pacific papers on educational technology (ET) published internationally: from 13.7 % in 2000 to 38.4 % in 2013. This study seeks to identify the overall trends and gaps in this research. Of the 4,332 articles published in five selected international journals between 2000 and 2013, 1,137 (26.2 %) from the Asia–Pacific region [the Asia–Pacific (AP) region includes countries specified by UNESCO and Western Asia (Middle East) countries defined by United Nations] were selected for analysis. It was found that the majority of these came from Taiwan, Korea, Australia, Singapore and China, revealing a need for more studies from such countries as Japan and Indonesia, West and Central Asia and the Pacific Islands. The papers most commonly addressed issues at the micro-level in formal education, particularly higher education, focusing on the introduction of digital technology into on- or off-campus settings. There were few macro-level studies into such areas as policy making, quality assurance or evidence of educational outcomes and impact. It is suggested that researchers should undertake more such comprehensive studies into ET integration, not only in formal education but non-formal, informal, incidental and implicit learning.

Keywords Asia–Pacific perspective · Educational technology · Research trends

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Introduction: worldwide trends in educational technology research

Educational technology as tools in education

Research into educational technology (ET) has a long history, ranging from early instructional theory and trials with a succession of technologies in the pre-digital age to today's investigations into e- and m-learning. During 1960–1980s, as Ross et al. (1992) observed, much of the research concerned instructional systems and models based upon behavioral theory, applications of Bloom's taxonomy, Skinnerian teaching machines, program learning, Glaser's instructional systems design models and Gagné's conditions of learning. As Winn (2002) concludes, research during this period was primarily concerned with instructional design. Overlapping with this, as Simonson (2003) found, researchers began to focus on the production, use and effects of the various emerging technologies: audio, still pictures, film, video and early forms of computer-based learning. Much of this work was in university settings, but there was some research in the schools sector: For example, Papert's (1980) attempts to mediate computer-based learning with Piagetian theories of learning.

During the 70 and 80 s, questions were being continually asked whether certain media or technologies could improve learning and be considered a treatment variable (Hannafin and Young 2008). During this period, Clark (1983) made his famous assertion that media do not influence learning, saying, 'The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition' (p. 445)—a position he has continued to defend (Clark 2001). Mihalca and Miclea (2007) observe that during this

period, research studies also revealed that there were no optimal or best instructional methods for all students.

The 1980s saw interest in cognitive psychology, interaction between media and learners, and from how content is presented to how learning can be enhanced. In the 1990s, the focus of the research turned to technologically advanced and networked computer-based systems and constructivist methods and, as Hannafin and Young (2008) observe, technology came to be regarded, not as a treatment, but rather as a means of implementing treatment strategies such as feedback or support. Winn (2002) concludes that research in the field became more concerned with 'learning in complete, complex and interactive learning environments' (p.331). And with the advent of learning management systems online tools such as discussion boards came to be used in blended and fully online teaching and learning. Currently, the focus has shifted to mobile devices and the use of massive open online courses.

Ross et al. (2010) find that recent studies embrace both cognitive and constructivist perspectives in the design of effective e-learning environments, for example, examining the effects of learning strategies to reduce unnecessary cognitive load by offering worked examples and using constructivist strategies to promote collaborative knowledge construction in online discussions. However, the majority of studies deal applications of digital technology within particular instructional and institutional contexts and fail to connect new findings with empirical findings from previous studies with older technologies.

Educational technology as systems, methods of organization and techniques

A more holistic view of ET addressing the technical, managerial and institutional complexities of educational change can be traced back to the 1960 and 1970s. Lumsdaine (1964) argued that 'instructional technology' required the application of scientific principles as well as instructional technology; Hoban (1965) held that the central problem of education was not learning but the management of learning; and Taylor (1971) observed that the newly adopted resource-based learning methods demanded new systems for dealing with the changes required in the existing institutions. When the UK National Council for ET was established in 1967, its all-embracing definition of ET was, 'The design, development, application and evaluation of *systems, methods and media* for learning' (italics added). Five years later, the newly formed America's Association for Educational Communications and Technology (AECT 1972, p.36) defined ET as: 'the facilitation of human learning through the systematic identification, development, organization and utilization of a full range of learning resources and *management of these processes*' (italics added).

Failure to adhere to the broader definition of ET, to enquire into how the various elements of innovations interrelate with each other and their impact on overall educational systems, leads Friedland et al. (2009) to observe that despite all the high expectations and the mass of reports on interventions in individual classes or programs suggesting that in certain contexts, learning technologies can have a positive impact, such innovations fail to be feasible and widely adopted in everyday teaching and learning. Latchem (2005) notes how many papers on ET reflect well upon the institutions, providers and programs and ignore or play down the failures and shortcomings.

Reviewing 695 articles in five major international distance education journals published between 2000 and 2008, Zawacki-Richter et al. (2009) found that most of these focused on instructional design and individual learning processes and ignored meso- and macro-level issues such as innovation, change management or intercultural aspects of learning. Rushby and Seabrook (2008) found that almost all of the questions being asked at that time about ET had already been answered, at least in part, in studies dating back for up to 30 years. They concluded that these findings were overlooked because the earlier studies were in print and on library shelves rather than readily available online and the current generation of educational technologists was focused on tools and methods rather than the broader issues of educational change. Selwyn (2011) argues that ET has become a curiously closed field populated by people who are particularly resistant to viewpoints that contradict the core beliefs that technology has limitless potential force for positive change.

Previous reviews into Asia–Pacific educational technology research

Using text-mining methods and bibliometrics to review the abstracts of over 600 refereed journal articles on e-learning in the region, Hung (2012) found that the number of papers increased from 11 in 2000 to 121 in 2008, with Taiwan and China the most prolific countries. He grouped the articles into two domains with four groups/15 clusters based on abstract analysis. The conclusions were that Asia–Pacific e-learning research is at the early majority stage, foci have shifted from issues of the effectiveness of e-learning to teaching and learning practices, and approaches to e-learning differ between leading and early adopter countries, and government policies play an important role in shaping these processes.

Hsu et al. (2013) examined the abstracts of 2,997 international research articles in six journals between 2000 and 2010 (four of which feature in the present study) and identified a total of 19 clusters of ET topics. They too found a tendency to research specific isolated learning environments while ignoring other research needs. They

categorized the three most popular topics as 'Macro View of Online Learning,' 'Learning Interactions and Online Collaborative Learning' and 'Macro View of Technology Integration.' Topics such as 'Technology-assisted Learning' and 'Attitude toward Technology' were consistently researched. Others such as 'Learning Styles' and 'Technology Adoption' were rarely researched.

In addition, Hsu, Hung and Ching found that the three top countries of first authors were the USA, UK and Taiwan. The US papers featured most frequently in the clusters of 'Macro View of Online Learning,' 'Learning Interactions and Online Collaborative Learning' and 'Instructional Design,' and the UK authors were mostly interested in 'Educational Software and Simulation.' In the Asia–Pacific papers, Taiwan published most frequently in 'Automated Instructional Systems,' 'Learning Interactions and Online Collaborative Learning' and 'Assessment in Technology-based learning Environments,' while Australia was primarily concerned with 'Macro View of Online Learning,' 'Learning Interactions and Online Collaborative Learning' and 'Macro View of Technology Integration.'

These studies showed that Asia–Pacific ET research is governed by a variety of orientations and approaches. However, these results do not necessarily reflect the totality of the research efforts by scholars in region. The present study therefore aims to identify the dominant issues and gaps in research undertaken by Asia–Pacific contributors.

Method

The study was conducted as described below.

Selecting journals

Five international journals were selected for this study: The *British Journal of Educational Technology*; *Educational Technology Research and Development*; *Computers and Education (C&E)*; *Educational Technology and Society (ETS)*; and the *Asia–Pacific Education Review (APER)*.

Table 1 shows each journal's publication year, its 2012 impact factor, the total number of papers published and the number of Asia–Pacific papers considered in this study. All these journals are rigorously refereed, indexed in the Social Science Citation Index (SSCI) and published in English, have international authorship and readerships, and focus on ET research, save for *APER* which represents the entire field of education including ET. It was decided to include *APER* in this review because it is a significant means of sharing findings between Asia–Pacific researchers. *ETS* is the only online journal included in this study.

Selecting papers from Asia–Pacific

Included in the analysis were research and development articles by Asia–Pacific authors. Field notes and book reviews were excluded. Out of 4,332 articles published in the five journals between 2000 and 2013, 1,137 (26.2 %) could be identified by their affiliation as from the AP. In the case of co-authored papers, if one or more of the authors were from the region, they were included in the analysis. The abstracts of these papers were used as the main analysis source.

Deciding upon a classification framework

To identify and classify the research topics of the selected papers, several classification tools were considered (Hung 2012; Ross et al. 1992; and Zawacki-Richter et al. 2009). The 'cluster tree of major topics in ET' by Hsu et al. (2013) was seen to be the most appropriate and reliable tool for this analysis. As explained earlier, the 19 clusters had been developed by using text-mining and clustering analysis of almost 3,000 ET research articles published between 2000 and 2010 in six international journals and these had been verified by three experienced researchers. Table 2 describes these clusters with examples of the topics addressed.

Table 1 Five journals selected for the present study

Journal	Year of first publication	Impact factor (2012)	Total number of articles published between 2000 and 2013	Total number of articles published by authors from the Asia–Pacific (%)
British journal of educational technology	1970	1.313	765	164 (21.4 %)
Educational technology research and development	1953	1.522	402	60 (14.9 %)
Computers and education	1976	2.775	1,803	557 (30.9 %)
Educational technology and society	1998	1.171	891	314 (35.2 %)
Asia–Pacific education review	2000	0.47	469	42 (9.0 %)
Total			4,332	1,137 (26.2 %)

Table 2 Nineteen clusters used to analyze articles for the study

Cluster	Description	Example
CL1: Macro View of Technology Integration	Studies discussing macro-view of technology (both new and old) integration in education in a variety of settings	Revisiting and reframing use of ICT: implications for the ICT integration in education
CL2: Macro View of Online Learning	Studies focusing on macro-view of online learning in K-12 schools, lifelong education and settings other than higher education	Rethinking lifelong learning through online distance learning in Chinese educational policies, practices and research
CL3: E-learning in Higher Education	Studies focusing on e-learning applications/policies in higher education	Comparing e-transformation in Japanese and Korean higher education
CL4: Educational Games	Studies on development, utilization and evaluation of computer/video/online games in education; Studies investigating interaction between game play and learner	Effect of computer-based video games on children
CL5: Technology-assisted Learning	Studies investigating effects of one or more pedagogical strategies in technology-assisted learning environment; studies comparing media effects; studies examining skills for technology-assisted learning	The educational e-book as a tool for supporting children's emergent literacy
CL6: Learning Styles	Studies focusing on effects of learning styles or individual differences in teaching and learning	The impact of individual differences on e-learning system satisfaction
CL7: Technology Adoption	Studies focusing on acceptance/adoption of technology in education, planned change	What makes teachers use technology in the classroom?
CL8: Attitudes Toward Technology	Studies investigating learners'/teachers' attitudes and/or perceptions toward technology	Comparison of older and younger adults' attitudes toward and abilities with computers
CL9: Learning Community	Studies focusing on learning community and/or a community of practice	Teachers making connections: online communities as a source of professional training
CL10: Instructional Design	Studies on development, application and/or evaluation of instructional design models/theories, or any instructional design issues	Research on cognitive load theory and its design implication for e-learning
CL11: Learning Objects	Studies on reusable learning objects	Learning objects and engagement of students in schools
CL12: Assessment in Technology-based Environments	Studies on a wide range of assessment and evaluation issues in technology-based learning environments	Rapid dynamic assessment of expertise to improve the efficacy of adaptive e-learning
CL13: Multimedia	Studies on development, implementation and/or evaluation of multimedia learning programs or environments	Engaging students in multimedia learning context
CL14: Educational Software and Simulation	Studies on development, implementation and/or evaluation of educational software, apps, and/or simulations	An authoring tool for generating adaptable learning resource (mobile e-learning authoring tool)
CL15: Computer-assisted Language Learning	Studies focusing on improvement language learning adopting digital technologies	Assessing metacognitive knowledge in web-based CALL
CL16: Automated Instructional Systems	Studies on development, implementation and/or evaluation of a comprehensive technology-based instructional system	Construction of an online learning system for decimal numbers through the use of cognitive conflict strategy
CL17: Learning Interactions/Online Collaborative Learning	Studies investigating interactions and online collaboration in teaching and learning	Toward a semantic forum for active collaborative learning
CL18: Online Discussions	Studies investigating various aspects of online discussions	Analyzing online behaviors, roles and learning communities via online discussions
CL19: Problem-solving	Studies focusing on problem-solving/problem-based learning studies	Problem-solving learning environment and assessment: A knowledge space theory approach

Classifying the papers

The 1,137 articles from Asia–Pacific sources were classified into the 19-element cluster by the paper's first author, who has 30 years of research experience in ET, and another scholar with 17 years of experience in the field. Initially, 230 articles or about 20 % of the papers were randomly selected for the two coders to evaluate. With an initial agreement rate of 83 %, they discussed their classifications until agreeing upon these. They then shared the task of

classifying the remaining articles. Finally, the second author confirmed the number of articles in each category and made some minor amendments to the classification.

The main research topic of each paper was identified in the abstract and then confirmed by the paper title and keywords. If the main topic could not be identified in this way, the entire text was consulted. If an article could be classified in more than one cluster, the study was further analyzed to identify its most important dimension.

Results

Overall trends

Table 3 shows the number and percentage of Asia–Pacific articles published by the five journals between 2000 and 2013. It was found that:

- The total number of published research articles increased every year, especially between 2007 and 2013, and particularly in *ETS* (20.8 % in 2000 and 62.7 % in 2013).

Figure 1 shows the number of articles published by country by journal between 2000 and 2013. It was found that:

- The largest number of papers (55) (mainly in *C&E* and *ETS*) was from Taiwan.
- The second largest provider was Australia (148 articles), followed by Korea (101 articles) and Singapore (83 articles).

Figures 2 and 3 reveal the growth in the number of articles by country by journal in two periods: 2000–2006 and 2007–2013. While most countries published more over time, Taiwan and Korea showed the greatest increase:

- During 2000–2006, the three most productive countries were Australia (76 articles), Taiwan (68 articles) and Israel (19 articles).
- From 2007 to 2013, the three most productive countries were Taiwan (486 articles), Korea (84 articles) and Australia (72 articles).

Research settings

Figure 4 shows the number of articles published by research setting between 2000 and 2013. Each line represents the number of published articles by research setting each year.

- Higher education was clearly the most popular research setting for Asia–Pacific researchers, especially after 2007.
- Research in the K-12 setting was the second most popular in most years, save for 2003, 2005 and 2010.
- The amount of research undertaken in non-formal/informal, corporate training and professional development settings was low.

Table 4 shows the rankings of research areas enquired into by the Asia–Pacific researchers.

- The five most commonly researched areas were Technology-assisted Learning (225 articles, 19.8 %); Assessment in Technology-based Environments (141 articles, 12.4 %); Automated Instructional Systems (98 articles, 8.6 %); Learning Interactions/Online Collaborative Learning (93 articles, 8.2 %); and Technology Adoption (80 articles, 7.0 %).
- Less commonly addressed were Multimedia (19 articles, 1.7 %); E-learning in Higher Education (16 articles, 1.4 %); Learning Objects (16 articles, 1.4 %); and Macro View of Online Learning (9 articles, 0.8 %).
- This finding differed from the research areas identified as most globally popular by Hsu et al. (2013), namely Macro View of Online Learning (17 %); Learning Interactions/Online Collaborative Learning (14 %); Instructional Design (9 %); and Computer-Assisted Language Learning (9 %).

Table 5 shows the changes in research topics over the 14-year period. Figure 5 presents the changes in research topics between 2000 and 2006 and then between 2007 and 2013. Several trends were observable:

- 'Technology-assisted Learning' and 'Assessment in Technology-based Environments' were two most popular topics in both periods but became more popular in the period 2007–2013.
- Articles related to topics such as 'Macro View of Online Learning,' 'Educational Games,' 'Learning Objects,' 'Online Discussions' and 'Problem-solving' appeared with increasing frequency in the journals, and noticeably in the later period, 2007–2013.
- 'Attitudes toward Technology,' 'Instructional Design,' 'Automated Instructional Systems' and 'Learning Interactions/Online Collaborative Learning' tended to be steadily researched.
- Research into 'E-learning in Higher Education' seemed to be decreasing (nine papers in 2000–2006, seven in 2007–2013).

Discussion

Trends in the Asia–Pacific papers

The region's research profile in the international literature is clearly on the rise. During this 14-year period, the number of papers from the region rose dramatically: from

Table 3 Number and percentage of articles published by Asia–Pacific region authors by journal between 2000 and 2013

	2000	2001	2002	2003	2004	2005	2006	2007
BJET	3 (11.1 %)	12 (25.0 %)	17 (32.1 %)	6 (12.8 %)	8 (17.8 %)	12 (20.0 %)	11 (21.6 %)	9 (12.7 %)
ETR&D	3 (13.6 %)	2 (8.3 %)	1 (5.0 %)	1 (4.6 %)	1 (4.6 %)	4 (15.4 %)	2 (8.3 %)	7 (31.8 %)
C&E	7 (12.5 %)	18 (28.6 %)	8 (19.5 %)	14 (31.1 %)	11 (30.6 %)	13 (27.1 %)	14 (25.0 %)	33 (27.1 %)
ETS	10 (20.8 %)	13 (31.0 %)	16 (20.0 %)	7 (16.3 %)	9 (20.9 %)	15 (22.4 %)	13 (16.3 %)	18 (25.7 %)
APER	1 (4.6 %)	0 (0 %)	1 (5 %)	0 (0 %)	2 (9.1 %)	2 (11.1 %)	1 (4.4 %)	6 (15.4 %)
Total (% of total articles published in five journals)	24 (13.7 % of 175)	45 (22.5 % of 200)	43 (20.1 % of 214)	28 (15.8 % of 177)	31 (18.5 % of 168)	46 (21.0 % of 219)	41 (17.5 % of 234)	73 (22.5 % of 324)

	2008	2009	2010	2011	2012	2013
BJET	11 (18.0 %)	11 (17.2 %)	13 (23.2 %)	21 (28.8 %)	21 (28.8 %)	9 (25.0 %)
ETR&D	5 (16.7 %)	4 (10.8 %)	5 (13.5 %)	4 (9.8 %)	13 (27.7 %)	8 (28.6 %)
C&E	71 (30.9 %)	58 (28.9 %)	92 (33.2 %)	77 (33.6 %)	78 (32.8 %)	64 (39.8 %)
ETS	39 (46.4 %)	28 (43.1 %)	27 (47.4 %)	32 (47.8 %)	49 (57.0 %)	37 (62.7 %)
APER	1 (2.2 %)	8 (15.4 %)	9 (18.4 %)	5 (10.0 %)	6 (9.4 %)	0 (0 %)
Total (% of total articles published in five journals)	127 (28.2 % of 450)	109 (26.0 % of 419)	146 (30.7 % of 476)	139 (30.2 % of 461)	167 (32.9 % of 508)	118 (38.4 % of 307)

24 (13.7 %) in 2000 to 118 (38.4 %) in 2013. This is because over the past years, higher education institutions in the region have introduced more doctoral programs in ET. Taiwanese universities, for example, now have a policy which requires graduate students to publish their studies in well-known international journals before earning a degree and in certain universities before submitting a dissertation proposal (C. Chu, personal communication, September 29, 2013). And more highly competitive promotion and tenure systems encourage academic staff to undertake more research and publish in international journals.

Between 2000 and 2013, Taiwan published more articles than any other Asia–Pacific country. This finding is consistent with other studies (Hsu et al. 2013; Latchem 2010). However, expressed as a percentage of country population, Singapore (83 articles, with 5.5 million people) was the most productive, followed by Taiwan (554 articles, with 23.4 million people), Australia (148 articles, with 22.7 million people) and Korea (101 articles, with 50.0 million people). The high productivity in Singapore is largely due to the government's vision for high-level manpower development, supported by policies and budget allocations for research and international publication (D. Tan Tiong Hok, personal communication, November 25, 2013). This factor also applies in Korea and Taiwan.

The significant increase in publications in *ETS* and *C&E* is also attributable to the nature of these two journals. Both accept papers from the computer science field that address issues in education. Taiwanese researchers in particular have been quick to seize opportunities to publish on such topics as automated instructional systems, assessment tools, software and games in these two journals, but not the broader, pedagogical, management and implementation issues. Also, as an online journal, *ETS* can publish more papers at a lower cost than print-based journals.

There are relatively few contributions from Asia's other global economic powers, India, China, and Japan, or from Malaysia, Indonesia, West and Central Asia and the Pacific Islands. Latchem and Jung (2009) show that there are some exciting and worthwhile developments in blended and e-learning in these countries, but there is need for more research capacity building and research output across the region.

Trends in research settings

As Fig. 4 shows, as in other parts of the world, the Asia–Pacific research focuses on formal education, particularly higher education and K-12 schooling. There is little research being conducted in non-formal education, informal learning, corporate training or professional development, despite the enormous educational, social and economic benefits that these can bring (Latchem, in process). The average tertiary gross enrollment ratio in Asia–Pacific

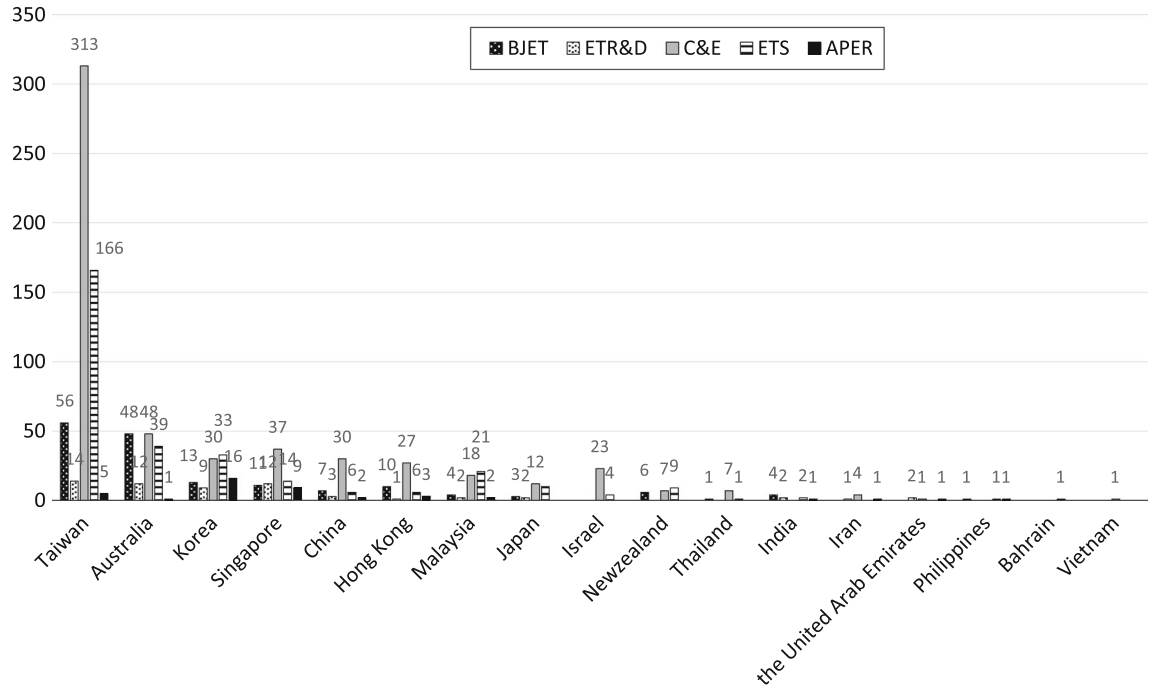

Fig. 1 Number of articles published by country by journal between 2000 and 2013

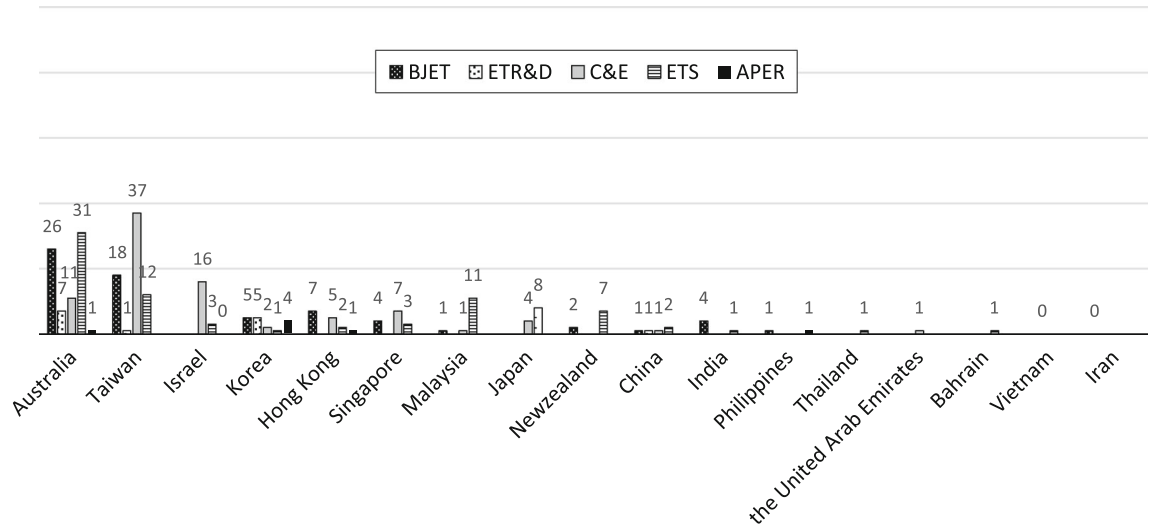

Fig. 2 Number of articles published by country by journal between 2000 and 2006

region is around 30 % (UNESCO Institute for Statistics, 2011), but the best means of meeting the educational and training needs of the other 70 % of the region's population must be also investigated and with the same rigor as in formal education settings.

Gaps in research areas

The analysis shows that while empirical studies in technology-assisted learning are being embraced in the Asia–Pacific and evidencing the positive effects of various interventions, as Culp et al. (1999) and Ross et al. (2010) observe of ET research in general, they are failing to adequately explain the ways in which technology applications facilitate learning and in which contexts, for whom and why.

Many of these studies address questions that have already been answered in earlier media research, but in the context of new technologies such as the Internet and mobiles rather than those of the pre-digital age. They

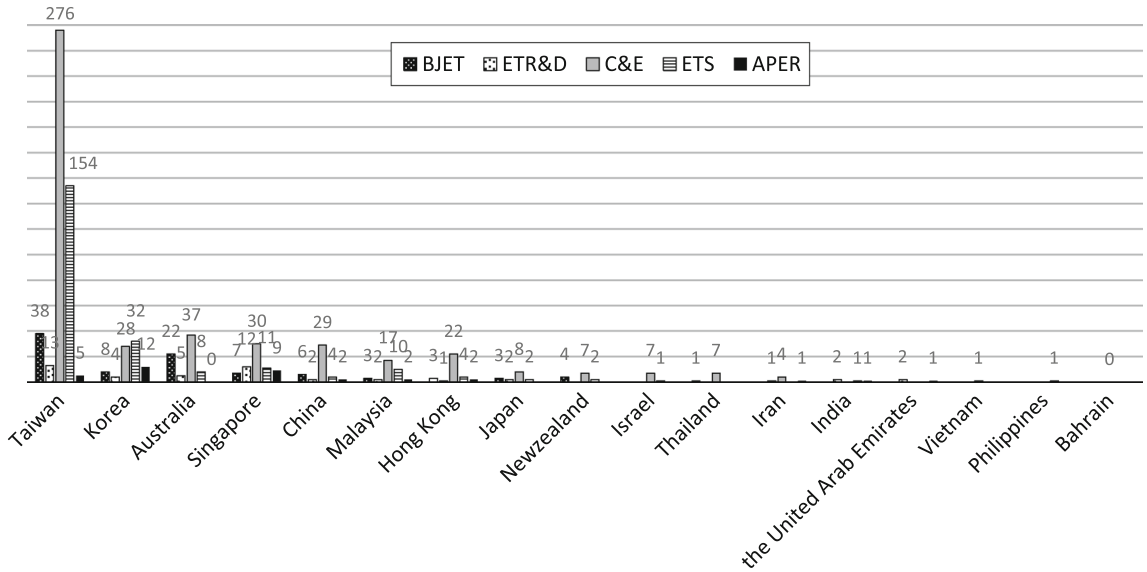

Fig. 3 Number of articles published by country by journal between 2007 and 2013

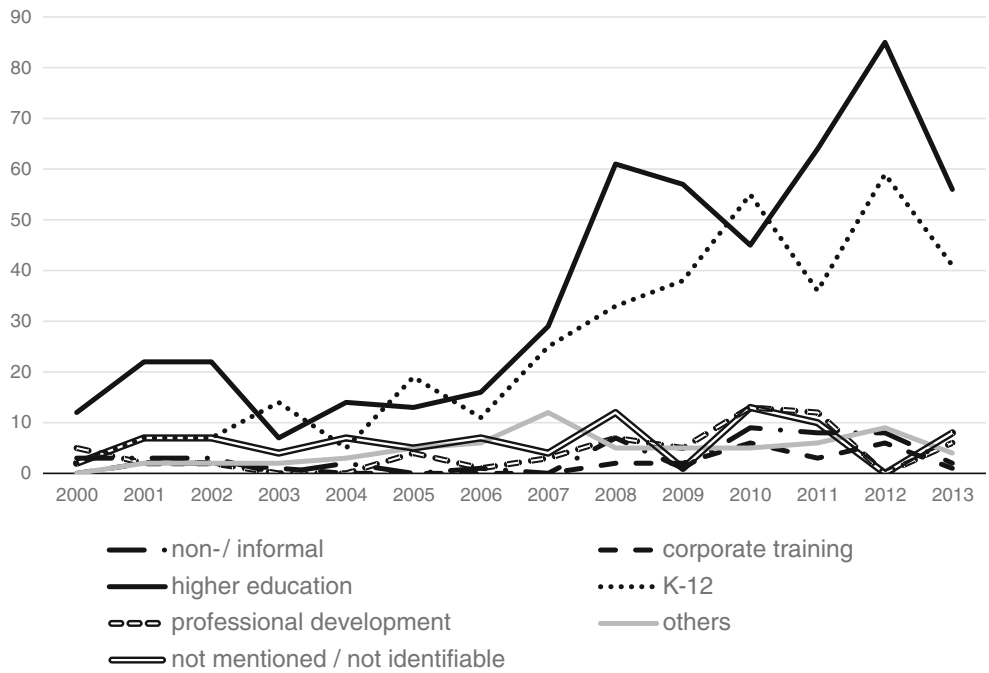

Fig. 4 Number of articles published by research setting between 2000 and 2013

ignore the consistent finding that a medium or technology itself does not make a difference in learning and a more important variable is instructional design (Clark 2001). They also ignore many other significant variables such as prior learning, learning circumstances and culture.

It would appear that in the rush to publish to fulfill a degree requirement or gain tenure or promotion, many graduate students and the younger generation of practitioners are disregarding the accumulated knowledge of past studies and are not prepared to address the knowledge gaps in the field, examine the bigger picture, ask original and challenging questions and adopt risky methodologies. As a result, highly ranked journals are receiving and rejecting an ever-increasing number of mass-produced, formulaic submissions from the region, and Taiwan in particular (C. Latchem, personal communication, October 31, 2013). As the publication requirement for graduate students spreads throughout Asia, more of such articles are expected. Government and institutional policies may be promoting more research and publication, but they are failing

Table 4 Ranking of research topics by number of articles (N = 1,137) published from the Asia–pacific region

Rank	Research topic	Number	%	International trends (%)[a]
1	CL5: Technology-assisted Learning	225	19.8	6
2	CL12: Assessment in Technology-based Environments	141	12.4	6
3	CL16: Automated Instructional Systems	98	8.6	6
4	CL17: Learning Interactions/Online Collaborative Learning	93	8.2	14
5	CL7: Technology Adoption	80	7.0	1
6	CL10: Instructional Design	66	5.8	9
7	CL14: Educational Software and Simulation	55	4.8	8
8	CL15: Computer-assisted Language Learning	50	4.4	2
9	CL1: Macro View of Technology Integration	47	4.1	9
10	CL8: Attitudes Toward Technology	45	4.0	4
11	CL6: Learning Style	44	3.9	2
12	CL4: Educational Games	41	3.6	3
13	CL18: Online Discussions	37	3.3	3
14	CL19: Problem-solving	29	2.6	3
15	CL9: Learning Community	26	2.3	3
16	CL13: Multimedia	19	1.7	2
17	CL3: e-learning in Higher Education	16	1.4	2
17	CL11: Learning Objects	16	1.4	2
19	CL2: Macro View of Online Learning	9	0.8	17
Total		1,137	100	

[a] International research trends by topic/area cluster in six educational technology journals from 2000 to 2010 (Hsu et al. 2013)

to improve the standing of ET and understanding and practice in the field.

There is also tendency for Asian-Pacific researchers to focus on small-scale, short-term studies and micro-research and to ignore macro-level issues such as organizational change and how best to embed and sustain ET in national and institutional settings. This too is due to 'short-termism,' with researchers working in competition and isolation from each other, and selecting research topics with readily available data and which accord with the experience and expertise of the researchers. To support and accelerate ET change and innovation in the region, more inter-disciplinary and collaborative research is needed at the macro-level. Currently, the macro-level studies needed to verify the success or otherwise of system-wide interventions require data from national and international sources and competencies to critically analyze these data in a broader social, economic, cultural and pedagogical context, and these the neophyte researchers often lack.

The researchers are also shown to be more interested in technology, technology adoption and attitudinal issues while Western researchers pay more attention to theories and models and exploring ET as an academic discipline in its own right. And very few Asia–Pacific studies pay heed to the need for new instructional theories or models which reflect the region's unique learning environments and cultures or the new affordances brought by ubiquitous technologies. There is great need for more of such research in this part of the world.

There is also another question that needs answering. The best of Western research and discourse welcomes contradiction and complexity, challenges assumptions and takes pleasure in stimulating rational debate. Do cultural hegemony, strong uncertainty avoidance and the centralized, directive and hierarchical structures in Asian countries (Hofstede 1984) make it difficult to contradict the assumptions of the group and undertake and openly report on the kinds of free radical research that can make a difference?

Conclusion: Implications for future research

This paper analyzed trends and gaps in ET research in the AP. It found a substantial increase in the number of publications being published internationally. While past research was criticized as being disconnected from practice (Winn 2002), much of the current research is being conducted in real learning environments, especially in higher education, examining technology-enhanced solutions to improving teaching, learning and assessment, which Spector (2013) sees as a critical research area.

However, while these papers are meeting international publishing standards, there is an ever-growing tail of substandard papers which do little to advance understanding and practice, even within their particular narrow contexts (C. Latchem, personal communication, October 31, 2013). More research is needed in macro-views of technology integration in education, and the proven benefits of e-learning, and instructional design theory and model building which takes account of cultural diversities and technology affordances.

More research is also needed from other southeast Asian countries such as Malaysia and Indonesia, West and Central Asia and the Pacific Islands. More research and reports are also needed in ET applied to non-formal, informal, incidental and implicit learning contexts, forms of learning

Table 5 Number of articles by research topic between 2000 and 2013(N = 1,137)

Research topics	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CL1	1	4	2	4	1	2	0	4	4	5	2	5	4	9
CL2	0	1	0	0	0	0	0	0	3	0	0	3	2	0
CL3	4	2	2	0	0	0	1	3	2	0	0	2	0	0
CL4	0	1	0	0	1	0	0	1	2	8	6	1	11	10
CL5	1	8	6	8	7	13	9	13	25	19	30	25	34	27
CL6	1	2	1	0	3	2	0	3	3	6	7	9	5	2
CL7	0	0	0	1	0	3	3	6	8	7	7	16	17	12
CL8	1	4	3	2	1	3	1	5	7	2	3	3	8	2
CL9	0	1	1	0	2	1	1	3	5	4	4	1	1	2
CL10	3	4	4	3	2	6	3	5	7	6	5	5	9	4
CL11	0	0	0	0	0	0	2	2	4	2	4	1	1	0
CL12	3	1	9	2	3	6	7	8	15	14	24	23	14	12
CL13	0	3	1	0	1	0	1	1	1	4	3	1	2	1
CL14	1	1	2	2	2	1	2	0	3	8	9	12	9	3
CL15	1	2	3	2	3	2	3	0	4	4	3	6	6	11
CL 16	5	7	5	3	3	2	2	10	13	7	13	6	14	8
CL17	3	3	2	1	2	2	1	5	12	7	17	15	16	7
CL18	0	0	1	1	0	1	2	2	7	5	3	2	9	4
CL19	0	1	1	0	1	0	3	1	2	1	6	3	5	5
Total	24	45	43	29	32	44	41	72	127	109	146	139	167	119

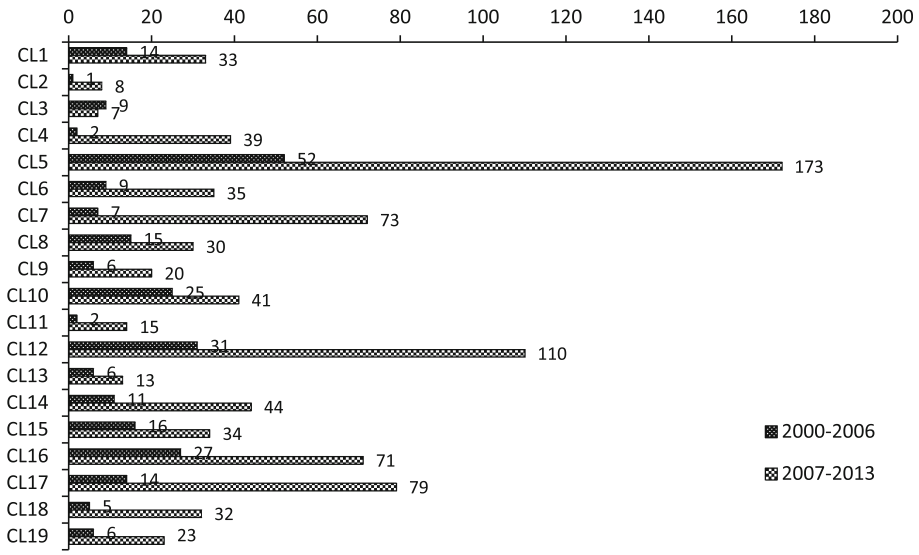

Fig. 5 Comparison of number of articles by research topic between 2000–2006 and 2007–2013

that are prevalent and critically important in the developing parts of the AP.

These findings need to be interpreted with a degree of caution. The study was limited to five international journals, mainly due to time constraints in manually analyzing huge amounts of data. The study adopted 19 research area clusters which covered all of the areas of research represented in these five journals. The journal selection and clustering may have failed to identify some emerging research trends and thus affected the finding of the study. Future studies need to include more publications from more diverse origins to ensure monitoring of research topics and trends across the region. A study into researchers' perceptions of ET, motivations for undertaking research and circumstances and levels of experience might also yield some useful insights into work in this field.

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